

COLLAPSIBLE STRUCTURES

Cross reference to Related Application

5 This application is a second Continuation-in-Part of parent US Patent Application 09/642,948 filed on August 22, 2000 and a first Continuation-in-Part US Patent Application 10/014,125 filed on December 11, 2001.

FIELD OF THE INVENTION

10 The present invention relates to collapsible self-supported structures. All of these structures have one or more of the following characteristics: adjustable length and/or, width and/or height, lightweight, easily collapsed, very compact when collapsed and easily carried, stored and transported. Embodiments disclosed
15 relate to pens, cribs, play yards, bed rails, wheeled carts, animal crates with and without wheels and collapsible structures with ceilings or roofs such as play houses, tents and covers for objects such as pallets of cement.

BACKGROUND OF THE INVENTION

Folding Cart

20 The present invention enables us to fill the unmet needs for a diverse population of cart users. The uses for such carts are virtually endless ranging from transport of hospital food, medical supplies, medical instruments, patient
25 belongings and other utensils, to carts used for mail delivery, catering, refuse removal, shopping, animal transport and many other home and business applications.

30 Carts used in these applications all generally have a problem with the amount of space required for storage or transport when the carts are not in use. To resolve that problem, some carts have been made to collapse or fold so that less space is required for storage. In general, most of these carts will fold in only one

direction thus leaving a large essentially two-dimensional object for storage. In this specification, we will disclose a cart frame that collapses in two directions to create a very compact collapsed frame to solve this problem.

In general, carts are made to a specific size that cannot be alter once the cart has been manufactured. Thus, a user requiring a cart of two different dimensions must chose to use a cart which doesn't fit the application of have two different carts. In this specification, we will disclose a collapsible, adjustable cart frame that can be adjusted by the user prior to use.

Baby Beds, Cribs, Play Pens, Play Yards, Bed Rails, etc.

This invention relates generally to collapsible box shaped structures like baby beds and including devices that act as cribs, playpens or play yards and the like. It does, however, also relate to structures having a side and a bottom such as a bed rail.

Traveling or camping with babies and very young children is often very difficult because a large amount of equipment is necessary to provide for the baby or young child. While it is known that certain devices may be collapsed for easier transport, many of these devices are still relatively difficult to store in a relatively small space. In addition, many or these devices are heavy, making it difficult to carry all of the necessary items for supporting the baby or young child.

For example, while collapsible playpens or play yards are known, they generally include a relatively heavy frame connected by hinges. The frame may be collapsed with some effort, and it is still necessary to transport the relatively heavy device from place to place. Moreover, as the size of the child increases the size and weight of the devices to accommodate them also tends to significantly increase. For a family traveling or camping with a baby or young child, this may mean not only must they transport the youngster, the youngster's clothing and food, but the heavy bed and perhaps playpen must be moved as well.

Another limitation on existing cribs, playpens and play yards is the size of baby or child that can be accommodated by the devices. A full size baby crib would generally be considered much to big for a new born infant and a bassinet

obviously would be too small for a one or two year old child. Thus the need to purchase several different beds and playpens to accommodate a child's early sleeping and play needs.

Thus, there is a continuing need for a baby and young child's bed and/or
5 confined play area which may be readily transported from place to place which may be easily set up at a new location, and which adequately protects the baby or young child. More over, it would be most desirable if one device could provide sleeping and play needs for the early periods of a child's life.

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Bed rails are often used for adult beds to keep children who are too big for a
15 crib from falling out of bed. Because the rails are long and bulky, they are generally difficult to store and transport as they do not collapse in more than one direction. It would be most desirable to have a bed rails that can be collapsed in more than one direction and can be easily stored or transported.

In this specification we disclose solutions to the aforementioned problems
20 related to baby beds, cribs, play pens, play yards, bed rails, etc.

Collapsible Structures with Tops, Ceilings or Roofs

The following are a few examples of collapsible six-sided structures (bottom, top and four sides) whose usefulness would be substantially improved by creating a structure that is collapsible in all directions and thus is more compact than simply
25 folding elements together.

Lightweight structures such as tents or rain flies often require the use of ropes to hold the tents in an upright position. The ropes which generally extend outward and downward from the tent's upper corners to a ground anchor somewhat distant from the tent often present a tripping hazard to people in the area and if the rope
30 happens to be pulled from the ground may cause the tent or rain fly to collapse. It

would be of significant help to have a rigid structure that does not require ropes to keep the structure in an upright position.

Another structure that could be improved with a frame that was collapsible in all directions is a children's playhouse. Most children's playhouses are constructed of solid sides and are generally not collapsible beyond taking the sides and roof apart. This makes the individual sides very bulky and causes significant difficulty in storing the entire structure. It would be of significant benefit if a playhouse that was easy to collapse in all directions such that the size of the storage area was significantly reduced and the ease of assembly and transport improved.

Another area of improvement is the protection of pallets of materials such as cement. Cement is very sensitive to moisture and is generally stored in a covered warehouse on pallets. When the pallets are taken to a construction site a covered storage area is generally not available so plastic tarps are used to try and protect the cement from the elements. The tarps are often blown off during storms and the cement is ruined. It would be most beneficial to have an easily removable collapsible structure that could be placed over the cement that would protect it from the elements.

Animal crates (with and without wheels)

Another embodiment of the invention relating to collapsible structures relates to crates. For purposes of discussion in this specification we have focused on animal crates, however, it is intended that the same embodiments will apply to any similar six-sided structure (top, bottom, and four sides) used as any type of crate, box or containment structure.

Crates currently used by animal owners are generally made of metal wire that has been welded to form an open mesh. The crates generally have five or six open wire mesh sides and a metal tray for a bottom. In general the crates are too heavy and awkward for a person to carry in an assembled form so it is necessary to take them apart and reassemble them at a new location. Because of the weight of some crates, it is often necessary to make several trips to move all of the crate parts when moving a crate. Moreover, the reassembly can be time consuming and frustrating.

An alternative method of moving the metal crates is to have a wheeled dolly upon which a crate can sit. The dolly also tends to be heavy and difficult to handle. Thus it would be an improvement to have a lightweight collapsible crate that can be easily carried and reassembled. Moreover, in cases where it is desirable to move an animal in the crate it would be desirable to have a crate on wheels.

In this specification we disclose a solution that applies to collapsible structures such as animal crates and to crates in general.

SUMMARY OF THE INVENTION

In this specification we describe a number of possible collapsible structure configurations and applications. All of the collapsible structures contain one or more of the following elements: anti-torque posts, crossed support arms, telescoping crossed support arms detachable horizontal support bar assemblies, and telescoping horizontal support bar assemblies.

In the detailed description we describe how each of the aforementioned elements are constructed and operate in relation to structures that collapse in at least two directions simultaneously. We disclose collapsible structures with fixed dimensions when opened and those whose dimensions can be altered. We disclose collapsible structures with and without wheels. In the details we provide a number of specific application examples for the collapsible structures enumerated.

BRIEF DESCRIPTION OF THE DRAWINGS

1. FIG. 1 is a perspective view of a basic collapsible four-sided cart frame.
2. FIG. 2 illustrates the effect of a heavy weight applied to the cart frame without anti-torque posts.
3. FIG. 3 is a cross sectional view of the front of a cart frame with anti-torque posts.
4. FIG. 4 is a perspective view of a collapsible four-sided cart frame with anti-torque posts.

5. FIG. 5 illustrates the cam lock attachment of a push bar to a vertical post.
6. FIG 6 illustrates a locking mechanism for two telescoping sections.
7. FIG. 7 illustrates a flexible Structure Locking Element attached by grommets to vertical posts passing through corner brackets.
- 5 8. FIG. 8 illustrates a tray or basket mounted inside a flexible Structure Locking Element.
9. FIG. 9 illustrates a flexible Structure Locking Element attached by shackles to upper corner brackets.
10. FIG. 10 illustrates a corner bracket modification to permit attachment of Structure Locking Elements from inside the collapsible frame structure.
- 10 11. FIG. 11 illustrates a rigid Structure Locking Element attached to vertical posts passing through corner brackets.
12. Fig. 12 illustrates using crossed arm support extensions as handles.
13. FIG. 13 illustrates a combination lower rigid Structure Locking Element and a flexible upper Structure Locking Element.
- 15 14. FIG. 14 is an expanded view of the lower corner bracket area of FIG. 13 illustrating the Structure Locking Element mounting post and cam lock end cap.
15. FIG. 15 illustrates a collapsible frame with an Anti Collapse Locking Mechanism attachment.
- 20 16. FIG. 16 illustrates telescoping crossed support arm assemblies that are used to adjust the length of a cart.
17. FIG. 17 illustrates the inner and outer tubular sections of a telescoping crossed support arm assembly of the type employed in this invention.
- 25 18. FIG. 18 illustrates a mechanism for locking the inner and outer telescoping tubular sections of the crossed support arm assemblies at points equal distance from the point of intersection of the two cross support arms.
19. FIG. 19A is a schematic illustration with telescoping crossed support arm assemblies unextended.
- 30 20. FIG. 19B illustrates the cart of 19A with telescoping crossed support arm assemblies extended.

21. FIG. 20 illustrates an extendable collapsible cart having pivotally connected detachable telescoping horizontal support bar assemblies.

22. FIG. 21 illustrates a pivotally connected detachable telescoping horizontal support bar.

5 23. FIG. 22A is a schematic illustration of a cart having pivotally connected detachable telescoping horizontal support bar assemblies in an open but unextended position.

24. FIG. 22B is a schematic illustration of a cart having pivotally connected detachable telescoping horizontal support bar assemblies in an open and extended position.

25. FIG. 23 illustrates a quick connect caster mounting to a corner bracket.

26. FIG. 24 illustrates shelf attachment fixtures attached to the four vertical posts for mounting an intermediate rigid shelf.

27. FIG. 25 illustrates an extendable collapsible crib frame.

15 28. FIG. 26a illustrates an extendable collapsible crib frame in an open extended position.

29. FIG. 26B illustrates an extendable collapsible crib frame in an open unextended position.

30. FIG. 26C illustrates an extendable collapsible crib frame in a partially closed position.

31. FIG. 27 illustrates a collapsible crib frame with flexible sidewalls and a flexible bottom.

32. FIG. 28 illustrates a collapsible crib frame constructed with detachable telescoping horizontal support bar assemblies.

25 33. FIG. 29 illustrates a collapsible structure sitting on leg extensions from the lower corner brackets and a rigid SLE attached to the lower corner brackets.

34. FIG. 30 illustrates a Tie Down Assembly to prevent tipping of a collapsible structure.

35. FIG. 31 illustrates an Anti-Tipping Assembly incorporated into a corner bracket design.

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36. FIG. 32 illustrates an Anti-Tipping Assembly incorporated into a corner bracket with provision for a ground spike.
37. FIG. 33 illustrates a collapsible set of bed rails.
38. FIG. 34 illustrates removable arches attached to upper corner brackets to provide for water run off.
39. FIG. 35 illustrates a bag with drawstrings for storage and transport of collapsible structures.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

In this specification like reference characters are used for like parts throughout the several views and similar parts at different locations are indicated by a letter following the part reference number. Thus for example, referring to FIG. 1 (This figure is also FIG. 1 from the parent application 09/642,948 filed on August 22, 2000 and hereafter referred to as "Parent") the four lower corner brackets 60A, 60B, 60C, and 60D may be referenced as individual brackets in this specification or when not referring to a specific bracket but rather the brackets in general as lower corner brackets 60. Also, in this specification the term "open" when used in connection with the description of a device is meant to mean the device in its functional or use configuration and "closed" is meant to mean the device in its collapsed or non-functional configuration.

Turning now to a discussion of the drawings. FIG. 1 illustrates a collapsible frame having two bisecting pivotally connected at 55 crossed support arms, 50A and 50B, 50C and 50D, 50E and 50F and 50G and 50H, per side with all crossed support arms being of equal length, four lower corner brackets, 60A, 60B, 60C and 60D, four upper corner brackets, 40A, 40B, 40C and 40D, to which said support arms 50 are attached as illustrated. Also illustrated are four casters, 70A, 70B, 71A and 71B, one attached below each of lower corner brackets, 60A, 60B, 60C

and **60D**. FIG. 1 also illustrates two vertical posts **30A** and **30B** with quick disconnects **220A** and **220B** for a push bar **20**.

It is from this basic collapsible frame structure that a number of new cart embodiments are disclosed. Although we will disclose each of the new
5 embodiments individually, it is our intent that the reader understand that many permutations and combinations of the new embodiments illustrated are possible.

We have found that when heavy loads are applied to the frame illustrated in FIG. 1, the front upper corner brackets **40C** and **40D**, and the front lower corner brackets, **60C** and **60D** will tend to move out of vertical alignment. This is a
10 problem since the wheels **70A** and **70B**, are mounted directly below the corner brackets **60C** and **60D** and are thus also forced out of vertical alignment and render the cart inoperative as illustrated in FIG. 2 (this figure is also FIG. 10A of the CIP of Parent filed 12/10/01 (hereafter referred to as CIP-1) with a slight modification – [footrest attachment brackets **133A** and **133B** removed])

The solution for this problem is the addition of telescoping anti-torque posts
15 **35A** and **35B**, as shown in FIG. 3 (This figure is also FIG. 10 of the CIP-1 with a slight modification – [hand grips **57**, seat **100**, and arm rests **105** have been removed]). FIG. 3 is a front cross sectional view of the cart front illustrated in Fig. 4. (Note – similar telescoping anti-torque posts **35** are also illustrated in FIG. 13 of
20 the CIP-1). FIG. 4 is identical to FIG. 1 with the exception of the addition of two telescoping anti-torque posts, **35A** and **35B**. In this embodiment as illustrated in FIG 3, two telescoping vertically aligned anti-torque posts, **35A** and **35B**, are comprised of lower posts, **132A** and **132B** attached to the two lower front corner brackets **60C** and **60D**. A second set of hollow slidable posts **131A** and **131B** are
25 positioned over lower posts **132A** and **132B**. In one version of the invention the upper ends of **132A** and **132B** are connected the upper front corner brackets **40C** and **40D** and in a preferred embodiment of the invention illustrated in FIG 3, the upper posts **131A** and **131B** extend through the upper front corner brackets **40C** and **40D** and are slidable within those brackets.

Thus, the upper portion of the anti-torque posts, **131A** and **131B**, are slidable through upper front corner brackets, **40C** and **40D**, and telescopically slide over the lower posts, **132A** and **132B**, during folding and unfolding of the cart. In fact, posts **131A** and **131B** slide over smaller internal posts **132A** and **132B** thereby making it possible to fully collapse the cart frame.

The system shown in FIG. 3 solves the caster twisting technical problem by preventing such torque distortion. This is accomplished by adding vertical telescoping anti-torque posts assemblies **35A** and **35B** that keep the upper and lower front corner brackets **40C** and **40D** and **60C** and **60D** in vertical alignment. In turn, this is because the torque forces are less than the vertical force of anti-torque posts **35A** and **35B**. In essence, the anti-torque functionality of this invention is provided by telescoping front posts **35A** and **35B**.

As illustrated in FIG. 3, the lower end of posts, **131A** and **131B**, are supported by the lower front corner brackets **60C** and **60D**.

FIG. 3 and FIG. 4 illustrate cam lock connectors, **115A** and **115B**, attached to the upper ends of the telescoping anti-torque posts, **131A** and **131B**. These cam locking connectors, **115A** and **115B**, provide a means for locking a tray, basket, bag, web or other Structure Locking Element in place when the collapsible cart is in open and use position. In addition, the can lock connectors, **115** are used as a stopper mechanism to lift the upper end of the telescope the upper anti-torque posts, **131A** and **131B** when they come in contact with the upper corner brackets **40C** and **40D** as the cart is collapsed. The operation of the cam lock connectors is similar to that of the quick connect fittings **220** that will be described later.

Although cam lock connectors are used in FIG. 3 and FIG. 4 to lock the Structure Locking Element in place is used as illustrative of the function. Any attachment mechanism that can be easily removed and reinstalled can also serve the same function.

In a preferred embodiment of the invention, the lower sections **132A** and **132B** (see FIG.3) of the telescoping anti-torque posts **35A** and **35B** have the smaller diameter and slide inside the larger diameter sections **131A** and **131B** that are on

top. It is known, however, that the reverse orientation could have been applied. In addition, the inside posts may be of hollow or solid construction.

The length of the lower sections of the telescoping anti-torque posts, **132A** and **132B**, is such that these posts have a considerable overlap with the front upper sections of the anti-torque posts, **131A** and **131B**, when the device is in the collapsed position such that they will not be easily separated. Thus, a portion of the interior sections **132A** and **132B** are always contained within the upper outer sections **131A** and **131B**. For the first time in the art of cart design this telescoping system makes it possible to use a flexible or removable cart frame support structure and maintain the casters in alignment during use and still have a collapsible cart closing simultaneously in the X and Y direction.

The Parent application that focuses on a mobility device and chairs described elements **30A** and **30B** in FIG. 1 as vertical backrest posts to which a removable push bar **20** is mounted. The CIP-1 further defined the posts **30** and push bar **20** as having a quick connect means in order that they can be quickly connected and disconnected prior to the unfolding and folding operations. The CIP-1 further state that because the push bar **20** might be used to lift, tilt and push mobility device it must be strongly connected to the backrest posts **30**. One means of achieving this attachment is to use a cam locking quick connect fittings **220** attached to the ends of the push bar **20** and to the upper ends of the vertical backrest posts **30A** and **30B** as illustrated in FIG. 5 (This is FIG.13A from CIP-1 in a reverse position).

In FIG. 5, illustrates how the vertical post **30A** is installed into the quick connect fitting attached to the ends of push bar **20** by rivet **228A**. The vertical post end **31A** is inserted into the quick connect fixture body **224A**. The cam lock arms **221A** and **222A** are attached to the quick connect fixture body by pins **225** that allow the arms to rotate from a near downward pointing direction to a near upward pointing direction. As the cam lock arms **221A** and **222A** rotate upward frictional pressure is applied to the vertical post end **31A** thus locking it in place. To remove the push bar the process is reversed. Grooves **223** or similar detents may be incorporated into the vertical post end **21A** at the point of intersection with the cam

lock arms **221A** and **222A** to insure a non-slip fit. A similar action is preformed to lock vertical post **30B** into its associated quick connect fixture.

Although the quick connect fitting illustrated in FIG. 5 is attached to the push bar **20**, the reversing the mounting with the quick connect fixture attached to the rear vertical posts **30** is possible. We prefer mounting the quick connect fixture on the push bar, since all encumbrances to sliding "Structure Locking Elements" (to be described later) over the vertical post **30** are removed. Moreover, the quick connect fixture on the push bar **20** can be used to lock the "frame structure elements in a fixed position. In a number of embodiments to be described later this will be the preferable embodiment.

When used as a collapsible cart frame the rear vertical posts **30A** and **30B** in FIG. 1 are not required to function as backrest posts as described in the Parent and CIP-1. In a number of cart embodiments they do, however, maintain their functionality as the mounting point for a detachable push bar **20** or handles that can be used to push, pull, lift and tilt the collapsible cart frame when configured in an open position and as non telescoping anti-torque posts.

In addition, the telescoping anti-torque posts **35** can be substituted for rear vertical posts **30A** and **30B**. This is desirable when the distance between the upper end of the vertical posts **30** and the upper rear corner bracket in the open position is less than the distance required for the end cap to travel when the cart fame is moved from an open to a closed position. When a telescoping anti-torque posts **35** are used as rear vertical posts it may also be desirable to provide a mechanism to lock the inner sections **132** and the outer sections **131** (FIG. 3) together so that attached handles or push bar can still be used to push, pull, lift or tilt the cart without separation of the telescoping anti-torque posts **35**. FIG. 6 (CIP-1 FIG. 6A) illustrates one method of locking inner sections **132** and outer sections **131** together. In this illustration, outer section **131** has a number of holes **539** into which a push button locking and release clip **537** can be inserted to lock inner section **132** into a fixed position. The smaller inner section **132** has a spring action push button lock and release clip **537** mechanism mounted inside. Thus, when the

push button locking and release clip **537** in the inner section **132** is lined up with a hole **539** in the outer section **131** the push button will move through hole **539** in the out section **131** and lock the sections together thereby preventing independent movement of one section.

5 It is also noted that a push bar can be connected to the end of the rear anti-torque posts **35** in a similar manner to that previously described for the rear vertical posts **30A** and **30B**.

Turning now to the Structure Locking Element embodiment that we will also refer to as SLE. For easy of understanding we have defined the SLE as the component element which when attached at or to the four upper corner brackets and/or at or to the four lower corner brackets holds the frame in a rigid fixed open position. The SLE keeps the frame in its desire upright position and prevents it from collapsing to the floor in the absence of a cross members such as the push bar **20** in FIG. 1.

15 SLEs can be of many shapes, sizes and materials and can be attached to or at the corner brackets in many ways. We will attempt to provide a number of general examples, however, these should not be considered as an all inclusive list, but rather only as examples of the embodiment.

Example 1: We start with a variation on a well known form of SLE, the seat for a camping chair. In this example we illustrate a SLE made of a flexible material such materials as webs, belts, fabric, rope, etc. FIG. 7, that is identical to FIG. 4 except for the addition of a flexible SLE **200** made of a nylon web, illustrates the corners of the SLE attached at the upper corner brackets **40A**, **40B**, **40C** and **40D**. In this example the SLE **200** is in the shape of a square because all of the crossed support arms are of equal length and thus by definition must form a square when open. In FIG. 7 we have illustrated grommets **210** placed in the four corners of the nylon web SLE **200** and the corner grommets **210** sliding over the rear vertical posts, **30A** and **30B**, and over the telescoping anti-torque posts, **35A** and **35B**. Thus the cart frame in FIG. 7 is held in a rigid fixed open position. This collapsible frame can then be converted into a useful cart for such purposes as hauling mail as

illustrated in FIG. 8. This is accomplished with the addition of a removable basket or tray **307** having an upper rim that rests upon the SLE, **200**.

At this point it is important to mention that although the SLEs **200** we discuss in this and the following examples are for carts having square openings in upper or lower corner brackets, the principles will also be applicable to rectangular frame embodiments that we will disclose later in the specification.

Example 2: Although this example uses a fabric web similar to that in Example 1, it differs significantly in that the SLE is offset inside the frame. This is very important when side walls are attached to the SLE since the offset prevents children and animals from striking or touching the collapsible frame when incorporated into play pens, cribs, and animal crates and carts.

This new offset flexible SLE **202** is illustrated in FIG. 9. In FIG. 9 the flexible nylon web SLE **202** is attached to each of the upper corner brackets **40** by means of shackles **211**. In this example, the upper corner brackets **40A**, **40B**, **40C** and **40D** have been modified as illustrated in FIG. 10, which is an enlarged view the area around the upper corner bracket **40B**, so as to have a ring **212** upon which to clip the shackles **211**. The shackles are attached to straps **201** which are attached to the outside corners of a flexible nylon web thus forming the SLE **202**.

Example 3: This example relates to a new concept of using a rigid SLE for structure support and user functionality simultaneously. In this example the Rigid Structure Locking Elements can be made out of many materials such as metal, plastic and composites. In the example illustrated in FIG. 11, we use a plastic tray **301** to illustrate the concept. The plastic tray **301** is constructed such that it has four vertical hollow tubes **302** molded into its four corners. The diameter of the vertical hollow tubes **302** molded into the plastic tray **301** are such that they just slide over the vertical posts **30A** and **30B** and **35A** and **35B** extending above the upper corner brackets **40A**, **40B**, **40C** and **40D** thus locking the collapsible frame into a rigid configuration when the plastic tray **301** is installed on the frame. The rigid plastic tray **301** is attached to the frame by sliding the four hollow tubes **302** down over the vertical posts **30A** and **30B** and **35A** and **35B**. The tray is seated

when the lower edge of the vertical hollow tubes **301** rest upon the top surface of the upper corner brackets **40**. Thus, when the rigid SLE is placed on the cart frame posts, it becomes a usable tray on a functioning cart.

Previously it was noted that in some embodiments attaching the push bar quick connect locking mechanism to the push bar rather than the ends of the vertical posts **30** or **35** was advantageous with some embodiments of the SLE. This represents one of those embodiments where a quick connect locking mechanism **220** mounted on the push bar **20** can, if properly designed, can be used to lock the plastic tray **301** into its fixed position.

FIG. 12 is similar to FIG. 11, and is used to illustrate yet another method for providing handles for a cart. In this embodiment, the upper ends **250C** and **250G** of side support arms **50C** and **50G** are extended through the upper corner brackets **40A** and **40B** and are pivotally attached to said brackets. (This is similar to the method described for creating armrest supports in the Parent application.) Said extensions of upper side support arm **250C** and **250G** are bent in a way that caused them to be parallel with the ground when the cart is in its open position. The rear vertical posts **30A** and **30B** are replaced by telescoping anti-torque posts **35C** and **35D**. Like previously described handles or push bars that are attached to vertical posts this type of handle can also be used to lift, tilt, push or pull a cart.

Example 4: In this final example we illustrate another new concept, using more than one SLE on the same collapsible frame and one or more Structure Locking Elements performing more than one function. In this example, the device being illustrated is a wheeled animal cart. FIG.13 illustrates a rigid SLE **304** attached to the lower corner brackets **61** and an offset flexible SLE **200** attached to the upper corner brackets used to configure such a collapsible cart frame.

FIG. 14 is an expanded view of the area around the lower corner bracket **61B** in FIG. 13. FIG. 14 illustrates an SLE mounting post **136** that has been added to each corner bracket **61** upon which a rigid SLE **304** is mounted. A cam lock end cap **137** is attached to the top of each SLE mounting post **136** to secure the rigid SLE **304** to each SLE mounting post **136**. The mounting blocks **150A** and **150D**

are where crossed support arms **50A** and **50D** are pivotally attached at **56**. In this example the rigid SLE **304** performs a dual function: first as an SLE to establish the frame structure and second as a tray on which to support the weight an animal.

Looking again at FIG. 13 we see the upper SLE **200** is attached to the upper corner brackets **40** in a manner similar to that previously described in Example 2. When the collapsible cart frame is open and held in place by SLE **200**, the rigid SLE **304** can be mounted on the SLE mounting posts **136** and secured by cam lock end caps **137** thus creating a frame supported by two Structure Locking Elements.

Turning now to another new embodiment that we define as the "Anti-Collapse Locking Mechanism". We use FIG. 15 to introduce the new concept of a flexible or rigid Anti-Collapse Locking Mechanism. In FIG. 15, shackles **211** are attached to each end of a nylon belt **139**. One shackle **211** on the end of the nylon belt is clipped to the clip ring **212** in upper corner bracket **40D** previously described in FIG. 10. A similar clip ring **212** has been incorporated into the lower corner bracket **60D** and the other shackle **211** is clipped to the lower corner bracket **40D** thus preventing the structure from collapsing should upward, downward or sidewise pressure be applied to the upper Structure Locking Element **202**. For crib, play pens, and animal crates and cart applications discussed later in this application, it is most desirable to lock the collapsible frame in an open position with an Anti-Collapse Locking Mechanism to prevent a child or animal from pushing on a SLE and accidentally collapsing the frame and causing injury.

Any rigid or flexible means or structure can be used to create an Anti-Collapse Locking Mechanism as long as it prevents the upper and lower corner brackets from separating and thus collapsing the frame while the device is in an open position. For example, Anti-Collapse Locking Mechanisms may be incorporated into rigid vertical posts, flexible sidewalls of a crib or animal crate or as separate members as demonstrated by the nylon strap **139** in FIG. 15.

In yet another embodiment of the invention we disclose how to adjust at least one dimension (length, width, or height) of the basic cart illustrated in FIG. 4. FIG 16, illustrates adjustability in the front to back direction. In FIG.16, the crossed

support arms **50C** and **50D** and **50G** and **50H** shown in FIG. 4 have been replaced by two pair of pivotally connected telescoping crossed support arm assemblies **350C** and **350D** and **350G** and **350H**. FIG. 17, illustrates a pair of telescoping crossed support arm assemblies **350** where each support arm is essentially identical with its
5 pivotally bound counter part and each crossed support arm is comprised of an intermediate tubular section **351** and a pair of outer tubular sections **352** that telescope opposite ends into and out of said intermediate section **351**. The telescoping crossed support arms in FIG. 17 are illustrated as having hollow intermediate tubular sections **351** and outer tubular sections **352**, however, either the
10 outer or the inner sections may be solid and the sections may slide over each other in either direction.

The point where the telescoping support arms **350** bisect each other and are pivotally connected is shown as **55**. The point where each crossed support arm **350** is pivotally connected to an upper or lower corner bracket **40** or **60** is shown as **56**.
15 FIG. 18 illustrates a means for locking all of the outer telescoping tubular sections **352** at positions equal distance to the pivotal connection point **55**. Each outer tubular section **352** has formed therein a plurality of longitudinally spaced holes **321**. Said holes **321** are spaced identically for each of the outer tubular sections **352** and on both sides. Thus assuring that the pivotal connection point **55** for each pair of
20 crossed support arms **350** remains centered within the side defined by a string stretched around the outmost ends of the four outer tubular sections **352** and because opposite sides are also identical, the opposite side is also centered in an identical position. Each intermediate tubular section **351** has a hole **322** formed therein similar to hole **321**. A hairpin or V-shaped leaf spring **323** is housed in the
25 inner end of each tubular section **351** and compressed between the opposing inside faces of tubular proximate holes **322**. One of the legs of each leaf spring **323** is provided with a radially projecting button **324** terminating in a rounded end and slidable engaging hole **322** and a selected axially aligned hole **321** to releasably lock intermediate tubular section **351** and respective tubular elements **352** and thus
30 releasably lock crossed support arm assemblies **350** at a desired adjusted length.

FIG. 19A is a schematic illustration of the cart frame in FIG. 16 with the telescoping crossed support arm **350C** and **350D** and **350G** and **350H** in a non-extended position. FIG. 19B shows the same frame with telescoping crossed support arm assemblies **350C** and **350D** and **350G** and **350H** extended. Thus, by
5 extending all of the telescoping opposite side crossed support arms (this keeps the bisecting points of the two sides of the cart centered) the length of the cart can be extended without changing the height or width. The width of a cart can also be adjusted by applying the same principle of telescoping crossed support arms to the front side and back side. Like wise, the length and the width can both be adjusted
10 independently of each other on the same cart by using telescoping crossed support arm pairs on all sides of a cart. Moreover, a cart's height can also be raised or lowered while keeping the same width and length through the use of telescoping crossed support arm pairs on all sides.

In yet another embodiment of the invention an adjustable collapsible cart,
15 FIG. 20 illustrates a cart having telescoping crossed support arm assemblies **350G** and **350H** on one side and pivotally connected detachable telescoping horizontal support bar assemblies **355C** and **355D** on the other side.

As illustrated in FIG. 20, the detachable telescoping horizontal support bar **355C** is pivotally connected to front upper corner bracket **40C** at **56** and has a
20 snap fitting **280** mounted on the other end in order to quickly connect and disconnect from the front upper corner bracket **40B**. The other detachable telescoping support bar **355D** is pivotally connected to front lower corner bracket **60B** and has a snap fitting **280** mounted on the other end in order to quickly connect and disconnect from the front lower corner bracket **60C**. The rear upper
25 corner bracket **40B** and the front lower corner bracket **60C** have been modified to include a ring into which the snap fittings **280** can be connected. The pivotally connected detachable telescoping horizontal support bar assemblies **355C** and **355D** telescope in a manner similar to that previously described for an intermediate and outer section of a telescoping crossed support arm.

As illustrated in FIG. 21, each pivotally connected telescoping support bar 355 has an inner tubular section 351 that slides within an outer tubular section 352. The outer tube 352 has formed therein a plurality of longitudinally spaced holes 321. Said holes 321 are spaced to create a predetermined bar length. The intermediate tubular section 351 has a hole 322 formed therein similar to hole 321. A hairpin or V-shaped leaf spring 323 is housed in the inner end of each tubular section 351 and compressed between the opposing inside faces of tubular proximate holes 322. One of the legs of each leaf spring 323 is provided with a radially projecting button 324 terminating in a rounded end and slidable engaging hole 322 and a selected axially aligned hole 321 to releasably lock intermediate tubular section 351 and respective tubular element 352 and thus releasably lock the telescoping horizontal support bar 355 in a fixed position. Predetermined bar lengths are established to keep the frame in a rectangular shape, thus keeping an equal distance between upper corner brackets 40C and 40B and 40A and 40D and lower corner brackets 60A and 60D and 60C and 60B.

FIG. 22A is a schematic illustration of the cart frame in FIG.20 with the telescoping crossed support arm assemblies 350G and 350H the detachable telescoping horizontal support bar assemblies 355C and 355D in an open non-extended position. FIG. 22B shows the same frame with telescoping crossed support arm assemblies 350G and 350H and the detachable telescoping horizontal support bar assemblies 355C and 355D extended. Thus, by extending all of the telescoping crossed support arm assemblies 350G and 350H and keeping the bisecting point centered and by extending the detachable telescoping horizontal support bar assemblies 355C and 355D the length of the cart can be extended without changing the height or width. The width of a cart can also be adjusted by applying the same principle of telescoping crossed support arm assemblies to the front side or back side and detachable telescoping horizontal support bar assemblies to the opposite front or back side. Like wise, the length and the width can both be adjusted independently of each other on the same cart by using a combination of

telescoping crossed support arm pairs and detachable telescoping horizontal support bar assemblies on all sides of a cart. Moreover, a cart's height can also be raised or lowered while keeping the same width and length through the use of telescoping crossed support arm pairs on all sides.

Referring now to the wheels for the collapsible frame structures disclosed in this specification. Because each corner bracket must move in both the X and Y direction to open, close or expand the collapsible structures described in this specification, a wheel or set of wheels must be mounted at each corner bracket for wheeled collapsible structures. These wheels will typically be of the caster type, however, any set of wheel that can be mounted from the corner brackets is acceptable. In known fixed attachment systems, casters can be mounted in vertical posts such as the vertical rear support posts, **30A** and **30B** (FIG. 1). Alternatively, casters can be mounted to the lower corner brackets, **60A**, **60B**, **60C**, and **60D**, (FIG. 1).

One of the preferred means for caster attachment to the collapsible frames is a quick connect and disconnect attachment system as illustrated in FIG 23 (FIG. 6B from CIP-1). As illustrated, each lower corner bracket **60** has an opening into which the caster's stem **78** slides. The caster **71** is attached to the corner bracket by a removable pin **161** which slides through a prebored hole in the corner bracket **162** and through a prebored hole in the caster stem **76**. Thus, each caster can be rapidly locked into a corner bracket **60** by inserting the pin **161** as described or unlocked when the pin **161** is removed, thereby providing a quick connect means.

Selection of the type of caster to be used on the collapsible frame is optional and will depend upon the end use application. Both rigid casters that have a fixed direction and swivel casters that rotate will provide satisfactory results on the collapsible frame. Typically, a set of both rigid and swivel casters will be selected with the rigid casters generally located under the back of the collapsible frame where the handle is generally located.

Previously we have talked about shelves that can be attached at the upper or lower corner brackets that may also function as Structure Locking Elements.

Another embodiment of the invention relates to collapsible shelves that are intermediate to the upper and lower corner brackets. These shelves may be either rigid or flexible and may be detachable or fixed. A rigid shelf is illustrated in FIG. 24. Shelf attachment fixtures **90** for mounting a rigid shelf are attached to the four vertical posts **30A**, **30B**, **35A** and **35B** and an intermediate rigid shelf **400** is then mounted on the fixtures after the cart is in an open position and is removed prior to collapsing the cart. For the case of a flexible shelf such as netting, the attachment fixtures **90** could be clips mounted on the posts and attached to four corners of a mesh net. Such a mesh net shelf would not have to be removed when the cart was open and collapsed.

Referring now to cribs, beds, playpens, pens or play yards or a combination of these devices for use by babies, young children or pets. When the words crib, bed, playpen, pen or play yard are used in this specification it should be understood that they are being used interchangeably within this specification.

The collapsible frame structures that have previously been described for the construction of carts are also applicable to those of cribs, beds, playpens, play yards and bed rails. When referring to the following drawings we continue to use like reference characters. Looking now at the collapsible open-topped frame **100**, shown in FIG 25, which can fulfill the function of a collapsible frame for a sleeping bed or crib for a baby or young child or as a frame for a playpen or play yard when the baby or young child is not sleeping, we see the same elements previously described for collapsible carts.

The open topped collapsible frame in FIG. 25 is comprised of four telescoping sides with each side having a pair of crossed support arms **350A** and **350B**, **350C** and **350D**, **350E** and **350F** and **350G** and **350H**. Each pair of crossed support arms **350A** and **350B**, **350C** and **350D**, **350E** and **350F** and **350G** and **350H** are pivotally connected at their center of rotation **55** and all crossed support arms **350** are of equal length.

As illustrated in FIG. 17, each crossed support arms **350A** and **350B**, **350C** and **350D**, **350E** and **350F** and **350G** and **350H** are essentially identical in

construction with each arm comprised of an intermediate tubular section **351** and a pair of outer tubular sections **352** that telescope opposite ends into and out of said intermediate section **351**. FIG. 18 illustrates a means for locking the outer telescoping tubular sections **352** at points equal distance to the pivotal connection point. Each outer tubular section **352** has formed therein a plurality of longitudinally spaced holes **321**. Said holes **321** are spaced identically for each of the out tubular sections on a side and for each of the tubular sections on the side opposite. Thus assuring that the pivotal connection point **55** for each pair of crossed support arms **350** remains centered within the side defined by a string stretched around the outmost ends of the four outer tubular sections **352** on each side and also centered with the side opposite. Each intermediate tubular section **351** has a hole **322** formed therein similar to hole **321**. A hairpin or V-shaped leaf spring **323** is housed in the inner end of each tubular section **351** and compressed between the opposing inside faces of tubular element **351** proximate holes **322**. One of the legs of each leaf spring **323** is provided with a radially projecting detent **324** terminating in a rounded end and slidably engaging hole **322** and a selected axially aligned hole **321** to releasably lock intermediate tubular section **351** and respective tubular elements **352** and thus releasably lock telescoping crossed support arms **350** at a desired adjusted length.

For purposes of explanation the crib's **100** sides shall be labeled as follows, the side containing telescoping crossed support arms **350A** and **350B** shall be designated as the back and the side containing telescoping crossed support arms **350E** and **350F** shall be designated as the front. The left side as seen from the back facing the front incorporates telescoping crossed support arms **350G** and **350H** and the right side incorporates telescoping crossed support arms **350C** and **350D**.

As illustrated in FIG. 25, the crib **100** is comprised of four upper corner brackets **40A**, **40B**, **40C** and **40D** and four lower corner brackets **60A**, **60B**, **60C**, and **60D** and have telescoping cross support arms **350A** and **350B**, **350C** and **350D**, **350E** and **350F** and **350G** and **350H** attached to them as follows. The lower ends of the front right and left crossed support arms **350E** and **350F** and the lower ends of

the right side telescoping crossed support arm **350C** and the left side crossed support arms **350G** are connected to the lower right and left front corner brackets **60C** and **60D**; and the lower ends of the right and left rear crossed support arms **350B** and **350A** and the lower end of the rear right side telescoping crossed support arm **350D** and the left side telescoping crossed support arm **350H** are connected to lower right and left rear corner brackets **60B** and **60A**; and similarly, the upper ends of the left and right front telescoping crossed support arms **350F** and **350E** and the upper front ends of the right and left side telescoping crossed support arms **350D** and **350H** are connected to upper right and left front corner brackets **40C** and **40D** and upper ends of the left and right rear crossed support arms **350A** and **350B** and the upper back ends of the right and left side telescoping crossed support arms **350C** and **350G** are connected to the upper right and left rear corner brackets **40B** and **40A**.

All of the crossed telescoping support arms **350** are pivotally connected to the four upper corner brackets **40A**, **40B**, **40C** and **40D** and four lower corner brackets **60A**, **60B**, **60C**, and **60D** allowing the frame to expand or collapse simultaneously in both the X and Y direction. This is shown in FIG. 26A, FIG. 26B and FIG. 26C which illustrate respectively through schematic drawings, an open collapsible crib frame with telescoping crossed support arms extended, an open collapsible crib frame with telescoping arms unextended and a nearly collapsed crib frame. In the near closed position illustrated in FIG. 26C it can be seen that as the collapsible frame is closed all crossed support arms become essentially parallel to each other and upper and lower corner brackets will be separately aggregated together.

FIG. 27 is a cut away view of a crib frame that has flexible sidewalls **71** and a flexible bottom **80** attached. In the preferred embodiment of the invention, the sidewalls incorporate an SLE strap or web **200** into their construction. Said sidewalls **71** are generally placed inside the frame to form a protective barrier against a child falling and hitting the crossed support arm. The sidewalls **71** will generally be constructed of a flexible mesh fabric and the bottom will be made of a moisture barrier material to protect beds from possible urination accidents and children from

dampness and moisture from the ground when used as a playpen. In a preferred embodiment, the perimeter formed by the sidewalls **71** is designed to be smaller than the perimeter defined by the four upper corner brackets **40** or the lower corner bracket **60**. In this example, the sidewalls are also designed to act as an Anti Collapse Locking Mechanism. The sidewalls **71** are attached to the lower corner brackets when the crib is open thus locking the structure in an open position by preventing the upward movement of the upper corner brackets **40** that is required to collapse the structure when the collapsible frame is sitting on a hard surface.

A removable mattress (not shown) may also be added to the bed or play pen.

In yet another version of the collapsible crib frame as illustrated in FIG. 28, the back, front and left sides of the crib are constructed as previously described in FIG. 25. For purposes of explanation, the four-sided crib frame **101** illustrated in FIG. 28 has been labeled in a manner similar to that of the four-sided crib frame of FIG. 25. The side containing telescoping crossed support arms **350A** and **350B** is designated as the back, the side containing telescoping crossed support arms **350E** and **350F** is designated as the front and the side containing cross support arms **350G** and **350H** is designated as the left side. The remaining side is comprised of two telescoping horizontal telescoping crossed support arms **355A** and **355B** and is designated as the right side.

Each pair of telescoping cross support arms **350** is pivotally connected where the support arms bisect each other and are of equal length. As illustrated previously in FIG. 17, each telescoping crossed support arm is essentially identical and is comprised of an intermediate tubular section **351** and a pair of outer tubular sections **352** that telescope opposite ends into and out of said intermediate section **351** and is similar in functionality to those described in FIG. 25. FIG. 28 illustrates, two detachable telescoping horizontal support bar assemblies **355**. One support bar **355A** is pivotally connected to front lower corner bracket **60B** and has a snap fitting **280** mounted on the other end in order to quickly connect and disconnect from the front lower corner bracket **60C**. The other detachable telescoping horizontal support bar **355B** is pivotally connected

to the front upper corner bracket **40C** and has a snap fitting **280** mounted on the other end in order to quickly connect and disconnect from the upper corner bracket **40B**. The detachable telescoping horizontal support bar assemblies **355A** and **355B** telescope in a manner similar to that previously illustrated in FIG.

- 5 21. Each bar has an inner tubular section **351** that slides within an outer tubular section **352**. The outer tube **352** has formed therein a plurality of longitudinally spaced holes **321**. Said holes **321** are spaced to create a predetermined bar length when the previously described V-shaped or hairpin spring **323** is engaged into a specific hole. The predetermined bar lengths are established to keep the
- 10 frame in a rectangular shape, thus keeping an equal distance between upper corner brackets **40A** and **40D** and **40B** and **40C** and lower corner brackets **60A** and **60D** and **60B** and **60C**.

As illustrated in FIG. 28, the crib frame 101 is comprised of four upper corner brackets **40A**, **40B**, **40C** and **40D** and four lower corner brackets **60A**, **60B**, **60C** and

15 **60D**. All telescoping crossed support arms **350** for the back and left and right sides are connected to the upper and lower corner brackets as described in FIG. 25. The pivotal end of the upper detachable telescoping horizontal support bar **355A** is attached to the upper corner bracket **40C** and the pivotal end of the lower detachable telescoping horizontal support bar **355B** is attached to the lower corner brackets

20 **60B**.

Thus, the three pair of telescoping crossed support arms, the detachable horizontal telescoping support bar assemblies and the corner brackets form a size adjustable, collapsible open topped frame when the upper corner brackets **40** and the lower corner brackets **60** are spread apart and the horizontal telescoping bar assemblies **355** are connected. The collapsible frame can be made into a crib and

25 locked into position with the addition of an SLE. We have previously described in FIG. 27 an SLE 200 incorporated into the sidewalls **71**, and a bottom **80** that could also be used with the collapsible frame illustrated in FIG. 28. As previously described for FIG. 25, the crib frame is locked into its open position by SLE **201** which has

been incorporated into the sidewalls 71 and the side walls also acts as an Anti Collapse Locking Mechanism.

When it is desire to collapse the frame illustrated in FIG. 28 for storage or transit, the two detachable horizontal support bar assemblies, 355A and 355B are detached from corner brackets 60C and 40D. Once detached, these brackets can be telescoped inwards upon themselves and rotated so to a vertical alignment. Thus when all of the upper corner brackets are together, and all of the lower corner brackets are together, and all of the crossed support arms are lined up in essentially parallel alignment, the two detachable horizontal bar assemblies, 355A and 355B will also lay essentially in parallel alignment.

Because it is possible for one skilled in the art to construct many different variations of expandable collapsible structures using combinations of the embodiments of pivotally connected cross support arms 50, pivotally connected telescoping cross support arms 350, telescoping anti-torque posts 35 and detachable horizontal telescoping support bar assemblies 355 disclosed in this specification, we will limit the discussion of collapsible frame design to those already disclosed.

Although we have not discussed it during our presentation of crib frames, it is possible to attach or extend telescoping legs from the lower corner brackets 60 such that the crib sleeping area will be raised above the ground. As illustrated in FIG. 29, a rigid SLE 304 is attached to lower corner brackets 60A, 60B, 60C, and 60D to provide a surface upon which a mattress could be placed for sleeping. Telescoping anti-torque posts 35 are extended below the lower corner brackets 60 and are held in place by a locking mechanism like that illustrated in FIG. 6.

A preferred embodiment is to place the collapsible crib upon a juvenile or adult bed and thus take advantage of an existing sleeping space and mattress. To achieve this end we introduce an embodiment that makes this possible - the anti-tip straps. Small babies and children who do not crawl or walk are often left on beds in bassinets or similar type portable beds to rest as there is little risk or fear of the child tipping the portable bed by rolling over. However, as the child grows and gains the ability to stand and apply weight to the upper edges of a portable bed, the potential

exists for the child to topple the portable bed and fall onto the floor increases dramatically. Thus, children with the ability to stand and walk are not placed in portable beds resting on juvenile or adult beds.

FIG. 30 illustrates a Tie Down Assembly (anti-tip and anti-skid straps) that can be incorporated into the lower or upper corner brackets of collapsible beds that eliminates the potential for children who can stand and walk from tipping a collapsible crib. In FIG. 30, a collapsible crib frame **100** is placed upon a mattress **3**. A Tie Down Assembly **12** consists of detachable straps **600** that attach to each other or to the bed mattress **3** or frame and to the lower corner brackets **60**. FIG. 30 illustrates one end of detachable anti-tip straps **600A**, **600B**, **600C**, and **600D** attached with clips **601** onto each lower corner brackets **60A**, **60B**, **60C** and **60D** respectively. The anti-tip straps **600A** and **600B** are placed underneath the mattress **3** and are connected to a buckle **602** on **600D** and **600C** respectively. The straps **600** are then tightened to lock the collapsible crib frame to the mattress **3** thus preventing it from tipping or skidding should a child's weight be applied to in a manner that might otherwise cause the crib to tip or skid.

Once the concept of securing the collapsible frame to a juvenile or adult bed is recognized, one skilled in the art can derive many means of accomplishing the task of anchoring a collapsible crib frame to a bed. For example, to avoid having to go under the mattress **3** one might use a U shaped hook attached to a strap to hook onto the side of a mattress and then secure the strap to a corner bracket with a cinch buckle.

Alternatively, if the collapsible crib is to be used as a playpen on the ground, there will be no mattress to anchor the frame to in order to avoid tipping. FIG. 31 illustrates an Anti-Tipping Assembly that can be used with and without ground anchors. The Anti-Tipping Assembly consists of a lower corner bracket **60** that has pivotal connection points **56** for support arms such as crossed support arms, telescoping crossed support arms or telescoping horizontal support bar assemblies. The corner bracket **60** also has a cut out area **701** into which an anti-tip extension bar **700** fits. The cut out area on the lower corner bracket **60** is design such that the

anti-tip extension bar **700** provides a resistance force to any pressure applied to the frame in the direction of the anti-tip extension bar **700** and thus keeps the collapsible structure from tipping over. The lower corner bracket **60** is also designed to allow the anti-tip extension bar **700** to be removed from the corner bracket by moving the extended end of the anti-tip extension bar **700** downward to a perpendicular angle to the bottom of the corner bracket **60**, rotating the bar 90 degrees and dropping it out the bottom of the corner bracket **60**. Thus the crib can be collapsed to a very small size when the anti-tip extension bar **700** is removed when the frame is collapsed, yet provide stability when the frame is open and the anti-tip bar is installed.

When the anti-tip extension bar **700** is to be used for other collapsible structures such as protective sheds for building products, an additional ground spike modification is added to keep the collapsible structure from being lifted by the wind. FIG. 32 illustrates the addition of a spike **701** that is inserted into the ground through a hole in the anti-tip extension bar **700**. For easy of removing the spike **701** from the ground when it is desire to collapse the structure, a ring **702** has been added to the head of the spike **700**.

To this point, the specification has been directed to collapsible structures having four sides a top and a bottom. Another embodiment of the invention relates to rails for a child's bed. The principle of telescoping crossed support arms **350** also applies to this application. An example of this is when bed rails are desired for one side of a bed having a headboard **7** and a footboard **8** that sits against a wall and requires only a bed rail for one side only. FIG. 33 illustrates one design for a single collapsible side constructed using telescoping crossed support arms **350**. In this design the telescoping crossed support arms **350A** and **350B** are attached to lower corner brackets **60A** and **60B** that have a hinged horizontal protrusions **650** that slip under the mattress. An anti-tip/anti-slip strap **652** extends from the horizontal protrusion to a mattress hook **651** that attaches to the opposite side of the mattress from the telescoping crossed support arms **350**. A second set of straps **610** extends from the horizontal protrusions **650** to the upper corner brackets **40A** and **40B** to keep the side from being forced outward if weight is applied by a child. The

telescoping crossed support arms **350A** and **350B** are held in place by an SLE made of a nylon mesh sidewall with a web edging that connects to the upper corner brackets **40A** and **40B** and the lower corner brackets **60A** and **60B**. The bed rails are raised and lowered by shortening and lengthening telescoping crossed support arms **350A** and **350B** which collapse and open the structure.

Referring now to box structures in general and specifically to crates and animal crates. From the previous disclosures in this specification it can be seen by one skilled in the art that by using any number of combinations of crossed support arms **50**, telescoping crossed support arms **350**, detachable telescoping horizontal support bar assemblies **355**, telescoping anti-torque posts **35**, and vertical posts **30** a wide variety of variable size collapsible frames that collapse simultaneously in the X and Y directions can be created.

A preferred embodiment for an animal crate is to use an SLE like **201** in FIG. 9 with a collapsible frame like FIG. 28. Nylon mesh sidewalls and a top are attached to SLE **201** and a flexible water retardant polyvinyl chloride coated polyester fabric bottom is attached to the sidewalls. An Anti-Collapse Locking Element is incorporated by attaching the sidewalls to the lower corner brackets **60**. Anti-tip extension bars **700** are included to add stability when the crate is used to transport animals such as in the back of station wagons or SUVs. A zipper opening is provided on the right side of the crate under the detachable telescoping support bar **355A**.

In yet another preferred embodiment, a wheeled collapsible wheeled animal cart or crate is based on a modification of the cart described in FIG. 13.

Modifications include replacement of crossed support arms **50E** and **50F** with detachable horizontal support bar assemblies and replacement of crossed support arms **50C** and **50D** and **50G** and **50H** with telescoping cross support arms **350C** and **350D** and **350G** and **350H**. Nylon mesh sidewalls and a top are attached to SLE **200** and a flexible water retardant polyvinyl chloride coated polyester fabric bottom is attached to the sidewalls. The bottom flexible bottom rests on the lower SLE **304**. A

zipper opening is provided on the front side of the crate under the detachable horizontal support bar.

The collapsible wheeled animal cart described in this preferred embodiment is adjustable in length from front to back because of the telescoping cross support arms **350C** and **350D** and **350G** and **350H**. The detachable horizontal support bar assemblies are fixed in length and do not telescope. When the crate is closed the horizontal support bar assemblies are disconnected and rotated 90 degrees so that they are in line with the rest of the vertical posts and crossed support arms.

We will not attempt to enumerate all of the different combinations of collapsible wheeled structures that one skilled in the art might construct based on various combinations of crossed support arms, telescoping crossed support arms, detachable horizontal support bar assemblies, detachable telescoping horizontal support bar assemblies and anti-torque posts, however, these would be readily apparent to one skilled in the art given the disclosure of the embodiments enumerated in this specification.

Referring now to other applications for collapsible structures such as sheds, play houses, pallet covers, etc. In addition to the previously enumerate embodiments apply to these types of structures we add the concept of removable rafters or arches that are attached to upper corner brackets to create and arched, peaked, or domed support structure for a collapsible structure. The removable arched, peaked or domed structure can be used to support a flexible waterproof covering that can be attached from or over the structure to prevent the accumulation of water on the top of the collapsible structure. FIG. 34 is an illustration of two bendable plastic strips **97** that have been turned into flexible arches. The plastic strips **97** have been inserted into retaining pockets in the upper corner brackets **40** of a collapsible structure.

Alternatively, telescoping posts or vertical post extensions above the upper corner brackets **40** can be used to form peaks by inserting rubber connectors into the posts such that opposite sides can be easily bent together to form a peak when the opposite side upper ends are attached.

All of the collapsible structures can be placed in a fabric bag for storage or transport. FIG. 35 illustrates a fabric bag **900** with drawstrings **901** at the mouth of the bag for closure after a collapsible device has been placed in the bag **900**.

For purposes of this specification, a corner bracket is considered to be any
5 device which holds one or more support arms together or holds a SLE to the
outer end of a crossed support arm, a telescoping crossed support arm, or a
telescoping horizontal support bar.

Throughout this specification we have described telescoping crossed
support arms **350** as being comprised of intermediate sections **351** and outer
10 sections **352**. This was done for convenience in describing the embodiments. It
should be understood that any telescoping element can consist of a number of
intermediate sections and outer sections and that what is an outer section to a
centered intermediate section may also be an intermediate section to a further
outer section. Thus, any description of telescoping arm elements should be
15 considered to assume that the arm can have at least three or more sections.

Throughout this specification we have depicted the corner bracket in
illustrations as a solid piece to which the crossed support arms are pivotally
attached such as illustrated with corner bracket 61B in FIG. 14. The corner
brackets may, however, also be made of flexible materials such as a shock
20 cording material which will permit the support members to pivot from an open to
closed position and vice versa.

In the specification we talk about bisecting crossed support arms and
bisecting telescoping crossed support arms. It is our intent that the length being
divided in half is the distance between the upper and lower corner brackets on
25 each arm. Moreover, it is also our intent that when support arms are considered
to be the same length, that the length is measured between the upper and lower
corner brackets.

In the specification we refer to intermediate telescoping sections **351** and
outer telescoping sections **352** in relation to the center point of the arm with
30 respect to the other sections and not to whether a section slides inside or outside
of another tubular section. Although the examples have been illustrated with the

intermediate section being the smaller diameter tube over which the outer tube slides the converse is also possible.

Inner and outer tubular sections of telescoping bar assemblies **355** are also reversible and the telescoping bars may consist of more than two
s telescoping sections.